

WHAT IS CLAIMED IS:

1. An apparatus for determining a state of a measurable circuit element having a plurality of states and a different impedance in each state, comprising:
5 a replicate circuit configured to generate an adjustable test current; and
a trim determination circuit coupled with the replication circuit for receiving the adjustable test current, the trim determination circuit including the measurable circuit element and utilizing the adjustable test current to indicate at least one of the states of the measurable circuit element.

10 2. The apparatus as claimed in claim 1, wherein the replicate circuit includes a replicate circuit element having similar electrical characteristics as the measurable circuit element, the replicate circuit element providing feedback that is indicative of the amount of the adjustable test current.

15 3. The apparatus as claimed in claim 2, wherein the trim determination circuit generates a test current which is proportional to the adjustable test current whereby the test current is passed through the measurable circuit element such that a first voltage drop occurs across the measurable circuit element that is proportional to the impedance of the measurable circuit element.

20 4. The apparatus as claimed in claim 3, wherein the measurable circuit element has a lower voltage potential terminal whereby a voltage indicative of the state of the measurable circuit element is measurable at the lower voltage potential terminal.

25 5. The apparatus as claimed in claim 3, wherein the trim determination circuit has a scaled reference current source for generating a scaled reference current and a dependent measurable current source coupled with the scaled reference current source for generating a measured current whereby the amount of the measured current is a function of the first voltage drop across the measurable circuit element and the state of the measurable circuit

30 element is determined by the difference between the scaled reference current and the measured current.

6. The apparatus as claimed in claim 3, wherein the replicate circuit includes a threshold current source for supplying a threshold current that is proportional to a voltage drop across the replicate circuit element, an adjustable test current source coupled with the replicate circuit element and the threshold current source for establishing a feedback and for
5 supplying the adjustable test current within the feedback and a reference current source coupled with the threshold current source for supplying a reference current whereby the difference between the reference current and the threshold current provides the feedback to the adjustable current source and dictates the level of the adjustable current source.
- 10 7. The apparatus as claimed in claim 6, wherein the trim determination circuit has a scaled reference current source for generating a scaled reference current and a dependent measurable current source coupled with the scaled reference current source for generating a measured current whereby the amount of the measured current is a function of the first voltage drop across the measurable circuit element and the state of the measurable circuit
15 element is determined by the difference between the scaled reference current and the measured current.
- 20 8. The apparatus as claimed in claim 1 for use with a first sense voltage and the measurable circuit element having a first voltage drop there across, wherein the trim determination circuit includes a first amplifier having first and second inputs, the measurable circuit element being coupled with the first input for providing the first input with a measured voltage proportional to the first voltage drop, the first sense voltage being supplied to the second input, the first amplifier being configured to generate an output proportional to the difference between the measured voltage and the first sense voltage.
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- 30 9. The apparatus as claimed in claim 8, wherein the replicate circuit has a replicate circuit element having similar electrical characteristics as the measurable circuit element and an adjustable test current source for supplying the adjustable test current, the replicate circuit element being coupled with the adjustable test current source so that the adjustable test current passes through the replicate element resulting in a second voltage drop across the replicate circuit element.

10. The apparatus as claimed in claim 8 for use with a second sense voltage and the replicate circuit element having a second voltage drop there across, wherein the replicate circuit includes an adjustable test current source for providing the adjustable test current and a second amplifier having first and second inputs and an output, the replicate circuit element
5 being coupled with the first input of the second amplifier for providing the first input with a replicate voltage proportional to the second voltage drop across the replicate element, the second sense voltage being supplied to the second input of the second amplifier, the output of the second amplifier being coupled with the adjustable test current source for determining the amount of the adjustable test current.
- 10 11. An apparatus for improving the accuracy of a circuit, comprising an adjustable test current source configured to generate an adjustable test current, a replicate element coupled with the adjustable test current source for receiving the adjustable test current source and generating a first voltage drop across the replicate element where feedback is provided to
15 the adjustable test current source proportional to the first voltage drop for adjusting the adjustable test current resulting in adjustments in the first voltage drop, a test current source configured to generate a test current proportional to the adjustable test current, and a measurable element coupled with the test current source for receiving the test current whereby a second voltage drop results across the measurable element defines a state of the
20 measurable element.
12. The apparatus as claimed in claim 11, further comprising a measurable current source configured to generate a measured current proportional to the second voltage drop and a scaled reference current source coupled with the measurable current source for
25 generating a scaled reference current whereby the state of the measurable element is indicated by the difference between the measurable current and the scaled current.
13. The apparatus as claimed in claim 12, further comprising a measured voltage is defined between the measurable current source and the scaled reference current source and
30 is proportional to the difference between the measurable current and the scaled reference current for indicating the state of the measurable element.

14. The apparatus as claimed in claim 13, further comprising a reference current source for supplying a reference current, a threshold current source coupled with the reference current source for supplying a threshold current proportional to the first voltage drop and the adjustable test current source being coupled with the threshold current source whereby the
5 difference between the threshold current and the reference current provides the feedback to the adjustable test current source.

15. The apparatus as claimed in claim 11, further comprising a reference current source for supplying a reference current, a threshold current source coupled with the reference
10 current source for supplying a threshold current proportional to the first voltage drop and the adjustable test current source being coupled with the threshold current source whereby the difference between the threshold current and the reference current provides the feedback to the adjustable test current source.

15 16. The apparatus as claimed in claim 15, further comprising a measurable current source for generating a measured current proportional to the second voltage drop and a scaled reference current source coupled with the measurable current source for generating a scaled reference current whereby the difference between the measurable current and the scaled reference current indicates the state of the measurable element.
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17. The apparatus as claimed in claim 11, further comprising a first reference voltage, a first amplifier having a first and second input, the first input couples with the measurable element for receiving a voltage proportional to the second voltage drop and the second input receiving the first reference voltage, the amplifier being configured to generate a first output
25 proportional to the difference between the voltage at the first input and the first reference voltage.

18. The apparatus as claimed in claim 17, further comprising a second reference voltage, a second amplifier having a third and fourth input, the replicate element being coupled with
30 the third input for providing a voltage proportional to the first voltage drop, the fourth input receiving the second reference voltage, the amplifier being configured to generate a second output proportional to the difference between the voltage at the third input and the second

reference voltage, and the adjustable test current source couples with the second amplifier for receiving the second output providing the feedback to the adjustable test current source for adjusting the adjustable test current.

5 19. The apparatus as claimed in claim 11, further comprising a second reference voltage, a second amplifier having a third and fourth input, the replicate element being coupled with the third input for providing a voltage proportional to the first voltage drop, the fourth input receiving the second reference voltage, the amplifier being configured to generate a second output proportional to the difference between the voltage at the third input and the second reference voltage, and the adjustable test current source couples with the second amplifier for receiving the second output providing the feedback to the adjustable test current source for adjusting the adjustable test current.

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20. The apparatus as claimed in claim 19, further comprising a first reference voltage, a first amplifier having a first and second input, the first input couples with the measurable element for receiving a voltage proportional to the second voltage drop and the second input receiving the first reference voltage, the amplifier being configured to generate a first output proportional to the difference between the voltage at the first input and the first reference voltage.

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21. An apparatus for improving the accuracy of the circuit comprising a test current source for generating a test current, a measurable element coupled with the test current source for receiving the test current and generating a first voltage drop across the measurable element, a dependent measurable current source for generating a measurable current dependent on the first voltage drop across the measurable element, a scaled reference current source coupled with the dependent measurable current source for generating a scaled reference current and defining a measurable voltage between the dependent measurable current source and the scaled reference current source, whereby the measurable voltage is dependent on the difference between the measurable current and the scaled reference current.

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22. The apparatus as claimed in claim 21, further comprising an adjustable test current

source coupled with the test current source for generating an adjustable test current dictated by the level of the adjustable test current.

23. The apparatus as claimed in claim 22, further comprising a replicate element coupled 5 with the adjustable test current source for receiving the adjustable current and generating a second voltage drop across the replicate element.

24. The apparatus as claimed in claim 23, further comprising the adjustable test current source receiving a feedback for adjusting the second voltage drop across the replicate 10 element.

25. The apparatus as claimed in claim 24, further comprising a dependent threshold current source for supplying a threshold current dependent upon the second voltage drop across the replicate element.

15 26. The apparatus as claimed in claim 25, further comprising a reference current source coupled with the adjustable current source for supplying a reference current.

27. The apparatus as claimed in claim 26, wherein the dependent threshold current 20 source couples with the reference current source whereby the difference between the threshold current and the reference current dictating adjustments in the adjustable test current.

28. An apparatus for improving the accuracy of a circuit, comprising a measurable 25 circuit element having a plurality of states with a different impedance in each state and receiving a test current resulting in first voltage drop across the measurable element, a first amplifier having first and second inputs, the measurable device being coupled with the first input of the first amplifier for providing the first input with a measured voltage proportional to the first voltage drop, and a first sense voltage being supplied to the second input of the 30 first amplifier, the first amplifier being configured to generate a first amplifier output proportional to the difference between the measured voltage and the first sense voltage, whereby the first amplifier output designates a state of the plurality of states of the

measurable element.

29. The apparatus as claimed in claim 28, further comprising an adjustable test current source for generating an adjustable test current, a replicate element coupled with an
5 adjustable test current source for receiving the adjustable test current resulting in a second voltage drop across the replicate element producing a replicate voltage, whereby the adjustable current is dependent on the replicate voltage.

30. The apparatus as claimed in claim 28, further comprising an adjustable test current source for generating an adjustable test current, a replicate element coupled with an
10 adjustable test current source for receiving the adjustable test current producing a second voltage drop across the replicate element whereby the second voltage drop provides feedback control for the adjustable test current.

15 31. The apparatus as claimed in claim 30, for use with a second sense voltage and further comprising a second amplifier having a first and second input, the first input couples with the replicate element for receiving a first input voltage proportional to the second voltage drop across the replicate element, the second sense voltage being supplied to the second input of the second amplifier, the second amplifier being configured to generate a second
20 amplifier output proportional to the difference between the first input voltage and the second sense voltage, and the adjustable test current source couples with the second amplifier receiving the second amplifier output for controlling the level of the adjustable test current.

25 32. A method of improving the accuracy of a circuit, comprising the steps of generating an adjustable test current, passing the adjustable test current through a replicate electronic element, adjusting the adjustable test current as a function of a voltage drop across the replicate electronic element, providing a test current proportional to the adjustable test current, passing the test current through a measurable electronic element having at least two
30 states, where the measurable electronic element has a different impedance for each state, producing a voltage drop across the measurable electronic element, and determining the state of the measurable electronic element based on the voltage drop across the measurable

electronic element.

33. The method as claimed in claim 32, wherein the step of determining the test current including mirroring the adjustable test current.

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34. The method as claimed in claim 33, wherein the step of adjusting the adjustable test current including comparing a replicate voltage proportional to the voltage drop across the replicate electronic element with a sense voltage.

10 35. The method as claimed in claim 34, wherein the step of mirroring the adjustable test current including scaling the adjustable test current to produce the test current.

36. The method as claimed in claim 33, further comprising the steps of generating a reference current, generating a threshold current dependent upon the voltage drop across the

15 replicate electronic element, and adjusting the adjustable test current based on a difference between the threshold current and the reference current.

37. The method as claimed in claim 36, further comprising the steps of producing a measured current dependent upon the voltage drop across the measurable electronic

20 element, generating a scaled reference current proportional to the reference current and generating a measured voltage proportional to the difference between the measured current and the scaled reference current.

38. The method as claimed in claim 33, further comprising the steps of receiving

25 feedback and utilizing the feedback in determining adjustments for the adjustable test current.

39. The method as claimed in claim 32, further comprising the steps of producing a

30 measured current dependent upon the voltage drop across the measurable electronic element, generating a scaled reference current and generating a measured voltage proportional to the difference between the measured current and the scaled reference

current.

40. The method as claimed in claim 39, wherein the step of determining the state of the measurable electronic element includes determining the state based on a voltage level of the
5 measurable voltage.

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